

Appendix A. Disciplines Licensed by Massachusetts

Acoustical	Heating & Ventilation/ Air Conditioning
Aeronautical/ Aerospace	Industrial
Aeronautical	Instrumentation
Agricultural	Mechanical
Architectural Marine	Marine
Architectural	Metallurgical
Aerospace	Mining/ Mineral
Astronautical	Manufacturing
Civil	Material
Ceramic	Naval Architecture
Chemical	Nuclear
Construction	Plumbing
Corrosion	Petroleum
Control Systems	Plastics
Electrical	Quality
Electronic	Railroad
Environmental	Sanitary
Engineering Plastics	Safety
Fire Protection	Structural
Geological	Systems
Geodetic	Traffic
Geotechnical	Transportation
Highway	Textile

Appendix B: ISR Interview with Ten Comparison States on Regulatory Model and Request for Data

Registration data 1994/95 through 00/01:

1. We are requesting information on the number of registered engineers for each year from 1994/95 through 2000/01. If the number of registered engineers by discipline (based on the specialty exam) is available, we would prefer to have that information.

Exemptions:

2. Are there subgroups of engineers who are exempt from licensing? Which are they?

Exams:

1. How is your Engineer in Training (EIT) exam structured?
Does it have a breadth and depth section?
Which specialties are covered in the depth section?

2. We are requesting data from 1993 - 2001.
We need the number taking exams,
The cut points,
And the pass rates by exam type. (EIT, PE exams including specialties)

3. We would like to confirm the educational background and years of experience that your state requires people to have before taking the exam. Our research indicates that your state requires... [insert required educational background and years of experience to take exam from state codes, pull out info before calling] Is this correct?

Appendix B: ISR Interview with Ten Comparison States on Regulatory Model and Request for Data (cont.)

We are looking at the division of responsibilities between an appointive licensing Board and the State Agency that oversees Licensing of engineers. We have a few questions about who is responsible for what. [Boards are appointive; Agencies are full-time staff.]

1. First, who is responsible for hiring Board staff?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
 - e. The Board is staffed by the Agency
 - f. Other _____
2. Who is responsible for hiring Agency staff?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
3. Who makes decisions about office location, purchasing and procedures?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
4. Who maintains the financial records for licensing? (license and registration fees)
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
5. Are all Board expenditures covered by license and registration fees or are some covered by the state's general fund monies?
 - a. License and registration fees only
 - b. Fees and state general fund money
6. (If some state funding) Roughly what proportion of the Board's budget is contributed by the state? _____
7. Are all State Agency expenditures covered by license and registration fees or are some covered by the state's general fund monies?
 - a. License and registration fees only
 - b. Fees and state general fund money

Appendix B: ISR Interview with Ten Comparison States on Regulatory Model and Request for Data (cont.)

8. (If some state funding) Roughly what proportion of the Agency's budget is contributed by the state? _____
9. Does the state develop its own exams or does it use only NCEES exams?
- a. state develops its own exams
 - b. state uses only NCEES exams
 - c. state use a combination of NCEES & its own exams
10. Who's responsible for the preparation of exams?
- a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
 - e. State uses NCEES exams only.
11. What exams does the state administer? That is, do you offer a single exam to all engineers, or must licensees take an exam in a specialty area? In which specialties do you test?
- _____
- _____
- _____
- _____
12. Does the license specify a specialty area or discipline, or does it say "professional engineer"?
- a. Specified
 - b. Professional Engineer only
 - c. Mixed (specify _____)
13. Does the seal specify a specialty area or does it say "professional engineer"?
- a. Specified
 - b. Professional Engineer only
 - c. Mixed (specify _____)
14. Who sets the cut score of passing grade?
- a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required

Appendix B: ISR Interview with Ten Comparison States on Regulatory Model and Request for Data (cont.)

15. Who conducts and grades exams?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
16. Who sets qualifications for people taking the exams?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
17. Who collects the fees for exams?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
18. Who collects the fees for renewal of registration?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
19. Who answers inquiries from licensees and the public?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
20. Who prepares and mails applications for licensing and renewal?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required
21. Who issues licenses?
 - a. Totally the Board's responsibility
 - b. Totally the Agency's responsibility
 - c. Shared responsibility: Board initiated, Agency approval required
 - d. Shared responsibility: Agency initiated, Board approval required

Appendix B: ISR Interview with Ten Comparison States on Regulatory Model and Request for Data (cont.)

22. Who handles complaints?

- a. Totally the Board's responsibility
- b. Totally the Agency's responsibility
- c. Shared responsibility: Board initiated, Agency approval required
- d. Shared responsibility: Agency initiated, Board approval required

23. Who disciplines licensees?

- a. Totally the Board's responsibility
- b. Totally the Agency's responsibility
- c. Shared responsibility: Board initiated, Agency approval required
- d. Shared responsibility: Agency initiated, Board approval required

24. How are complaints against unlicensed individuals handled? What are the penalties? What agency or court has jurisdiction over unlicensed practice?

Complaint Data:

- 1. Do you log information on complaints in a computer database?
- 2. Would it be possible to obtain a copy of the complaint data for 1991-2001?
- 3. We will also need copy of the codebook for your complaint database.
- 4. (If complaint data is not available,) Would you have summaries of the data (frequencies) for all variables? What years are available? We would like summaries for 1991-2001.

Appendix C: Request for Consent of Release of Pass Rates

Memorandum

State of California
Department of Consumer Affairs

Date: December 13, 2002

To: Natalie Lowe, Florida Board
Thelma Barrington, Illinois Board
Deborah Milliken, Massachusetts Board
Arthur Russo, New Jersey Board
Jane Blair, New York Board
Andrew L. Ritter, North Carolina Board
Mark T. Jones, Ohio Board
Shirley S. Klinger, Pennsylvania Board
Lois Marshall, Rhode Island Board
Victoria J.L. Hsu, Texas Board

From: Board for Professional Engineers and Land Surveyors
Cindi Christenson, P.E. (916) 263-2285

Subject: Request for consent of release of pass rates

An independent study, mandated by the legislature, regarding the California Board's licensing structure is being performed by the Institute of Social Research (ISR). A part of this study is the comparison of California to 10 states which are similar to California in several aspects. One part of the study consists of comparing California pass rates with the pass rates in each of your states. ISR was advised that some or most of you do not retain pass rates statistics and that such data was available from the NCEES. I have contacted NCEES and they will release it with your consent. We would really appreciate your cooperation in this matter and are requesting that you consent to the release of this data by filling out the information below and faxing it back to my attention. I realize that this information is sensitive and the published report will contain only how California ranks amongst the 10 states and will not include a table that has state specific pass rate data.

Thanks again.

The State Board of _____ consents to allowing its pass rates released by the NCEES to the Institute of Social Research. In consenting to this release we understand that our state specific data will not be published in the final report.

Authorized Signature

Please fax to: Cindi Christenson FAX (916) 263-2221

Appendix D. Examples of Code Sections

San Francisco Municipal Code

Sec.2.6 Smoke Control Systems-Submittal Requirements

"2. Special Inspection must be overseen and coordinated by one of the following when approved by the Fire Department and the Department of Building Inspection:

- * Design Engineers of Record may fulfill the special inspection roll on projects that they have designed;
- * An approved California Registered Fire Protection Engineer with smoke management commissioning experience may coordinate and verify all components of the smoke-control system within his or her area of expertise, or;
- * An approved California Registered Mechanical or Electrical Engineer with building or smoke management commissioning experience may coordinate and verify all components of the smoke-control system within his or her area of expertise. "

Sec.4.14 Retroactive sprinkler requirements for existing high-rise buildings

"403.24.7.1 Members. Six of the nine members of the Board shall be the same persons and with the same terms as those appointed to the Board of Examiners pursuant to Section 105.1 of this code. ((One member of the Board shall be a licensed plumbing contractor, and shall be the same person and with the same term as the plumbing contractor member of the Board of Examiners - Plumbing, appointed pursuant to Section 105.1 of the San Francisco Plumbing Code. The two additional members of the Board shall be a)) The three remaining members of the Board shall consist of two registered fire protection engineers and ((a)) one representative of owners of buildings subject to the requirements of this section and shall be appointed by the Building Inspection Commission pursuant to the provisions of Section 105.1 of this code. The following shall constitute ex officio members of the Board, without vote and without compensation: the Chief of the Bureau of Fire Prevention and Investigation, and the Director of the Department of Building Inspection who shall act as Secretary of the Board." (sic)

Sec 1228. Applicant's Responsibility Upon Discovery of Hazardous Wastes.

"Unless Section 1227 is applicable, if the soil sampling and analysis report indicates that hazardous wastes are present in the soil, the applicant shall submit a site mitigation report prepared by a qualified person to the Director.

(a) For the purposes of this Section, a qualified person is defined as one or more of the following who is registered or certified by the State of California: soil engineer, civil engineer, chemical engineer, engineering geologist, geologist, hydrologist, industrial hygienist or environmental assessor.

(b) The site mitigation report shall contain the following information:

(1) A determination by the qualified person as to whether the hazardous wastes in the soil are causing or are likely to cause significant environmental or health and safety risks, and if so, recommend measures that will mitigate the significant environmental or health and safety risks caused or likely to be caused by the presence of the hazardous waste in the soil. If the report recommends mitigation measures it shall identify any soil sampling and analysis that it recommends the project applicant conduct following completion of the mitigation measures to verify that mitigation is complete;

(2) A statement signed by the person who prepared the report certifying that the person is a qualified person within the meaning of this Section and that in his or her judgment either no mitigation is required or the mitigation measures identified, if completed, will mitigate the significant environmental or health and safety risks caused by or likely to be caused by the hazardous wastes in the soil;

(3) Complete the site mitigation measures identified by the qualified person in the site mitigation report; and

(4) Complete the certification required by Section 1229. (Added by Ord. 35-99, App. 3/12/99) "

Sec.2910. Variance Board Establishment; Functions; Standards; Procedures.

"There is hereby created a Variance Board consisting of five members; one shall be qualified by training and experience in the field of acoustics or acoustical engineering; one shall be qualified by training, experience, and registration in the field of mechanical engineering; one shall be qualified by training, experience, and licensing in the field of architecture or civil engineering; one shall be a physician qualified in the field of physiological effects of noise; and one shall be a qualified audiometrist. Its functions shall be

Appendix D. Examples of Code Sections (continued)

to evaluate all applications for variance from the requirements of this Article with respect to noises emitted from truck-mounted waste or garbage loading and/or compacting equipment, and from fixed sources, and to grant said variances with respect to time for compliance, subject to such terms, conditions and requirements as it may deem reasonable to achieving compliance with the provisions of this Article. Each such variance shall set forth in detail the approved method of achieving compliance and a time schedule for its accomplishment. In determining the reasonableness of the terms of any proposed variance, said Board shall consider the magnitude of nuisance caused by the offensive noise, the uses of property within the area of impingement by the noise, the time factors related to study, design, financing and construction of remedial work, the economic factors related to age and useful life of equipment, and the general public interest and welfare. Any variance granted by said Board shall be by resolution and shall be transmitted to the Director of Public Health for enforcement. (Added by Ord. 274-72, App. 9/20/72) "

Sec.D3.750-1 Commission; Composition.

"The Department of Building Inspection shall be under the management of a Building Inspection Commission consisting of seven members. Four members shall be appointed by the mayor for a term of two years; provided that the respective terms of office of those first appointed shall be as follows: two for one year, and two for two years from the effective date of this section. Three members shall be appointed by the President of the Board of Supervisors for a term of two years; provided that the respective terms of office of those first appointed shall be as follows: three for one year from the effective date of this section. The initial appointments shall be made no later than fifteen days after the effective date of this section, and the commission's management shall begin no later than forty-five days after the effective date of this section. Vacancies occurring in the offices of appointive members, either during or at expiration of term, shall be filled by the electoral office that made the appointment. The four mayoral appointments shall be comprised of a structural engineer, a licensed architect, a residential builder, and a representative of a community- based non-profit housing development corporation. The three Supervisorial appointments shall be comprised of a residential tenant, a residential landlord, and a member of the general public. The members of the commission shall serve without compensation."

Los Angeles County Code

Sec.12.21.General Provisions

"(3) Structural Integrity Report. A Structural Integrity Report from a professional engineer licensed in the State of California documenting the following:

- (i) Tower height and design, including technical, engineering, economic, and other pertinent factors governing selection of the proposed design;
- (ii) Total anticipated capacity of the structure, including number and types of antennas which can be accommodated;
- (iii) Failure characteristics of the tower and demonstration that site and setbacks are of adequate size to contain debris in the event of failure; and
- (iv) Specific design and reconstruction plans to allow shared use. (This submission is required only in the event that the applicant intends to share use of the facility by subsequent reinforcement and reconstruction of the WTF.)"

Sec.17.05 Design Standards

"J. Hillside Areas. Design requirements for subdivisions in hillside areas shall meet the grading standards established by the Board of Public Work and the grading regulations established by Article I, Chapter 9 of this Code. Such requirements may also include providing soil reports prepared by a Registered Civil Engineer specializing in Soil Mechanics and/or reports on geological investigations."

Sec.22.341.City Engineer, Qualifications.

"The City Engineer shall be a Registered Civil Engineer with not less than five years of professional work experience."

Appendix D. Examples of Code Sections (continued)

Sec.62.250.Rail Transit Construction Impact.

"12. Worksite Traffic Control Plan. A Worksite Traffic Control Plan may be required by the Review Committee, which includes a drafted, 1" = 40' scale plan delineating base conditions, construction impact areas, site-specific detour operations, including traffic striping, pavement and curb markings, traffic control signs, signals, delineators, barricades, and traffic management requirements, at a precise level of detail. A Worksite Traffic Control Plan may be required where street work necessitates that motorists travel in paths for several days that conflict with permanent striping. The Worksite Traffic Control Plan and Traffic Circulation Plan, if required, shall be prepared under the direction of a Traffic Engineer or a Civil Engineer experienced in the preparation of Traffic Control Plans and registered in the State of California, and shall have the signed approval of the Division Engineer in Charge of Rail Transit Division, Department of Transportation, prior to the issuance by the Department of Public Works of the appropriate permit. "

Sec.91.220.S.

"Soil Engineer shall mean a civil engineer duly licensed by the State of California who is experienced in the application of the principles of soil mechanics in the investigation, evaluation and design of civil works involving the use of earth materials and who is approved by the Department, or a geotechnical engineer licensed by the State of California."

Sec.93.0206. Plans and Specifications

"(a) Plans and specifications required by the provisions of Subsection (b) of this Section shall be prepared by and bear the signature and registration number of a State of California Civil Engineer, Structural or Geotechnical Engineer (when the work is supplementary to Civil Engineering work), Electrical Engineer or Licensed Architect."

Sec.1303."G"Surface Mining Operations Districts.

"(a) A comprehensive soils engineering and engineering geologic investigation report prepared by a registered civil engineer and a certified engineering geologist, who shall not be employees of the applicant. The report shall indicate the type and features of Overburden and Minerals expected to be extracted and Mining Waste generated by the proposed Surface Mining Operations, and recommendations relative to setbacks, slopes, and excavations."

California Code of Regulations

TITLE 10. Investment \ Chapter 3. Commissioner of Corporations \ Subchapter 2. Corporate Securities \ Article 4. Standards for the Exercise of the Commissioner's Authority \ Subarticle 11. Oil and Gas Interests \ §260.140.122.2. Net Worth.

"(b) In determining the general partner's net worth, the value of proven reserves, as determined by an independent petroleum engineer, of oil, gas and other minerals owned by a general partner may be used. Notes and accounts receivables from all programs, interests in all programs, and all contingent liabilities will be scrutinized carefully to determine the appropriateness of their inclusion in the net worth computation."

TITLE 14. Natural Resources \ Division 5. San Francisco Bay Conservation and Development Commission \ Chapter 2. The Commission, the Staff, and the Advisory Review Boards \ Article 7. Advisory Boards \ §10271. Membership and Function of Engineering Criteria Review Board.

"The Engineering Criteria Review Board shall consist of not more than eleven (11) members, including at least one (1) geologist, one (1) civil engineer specializing in soils, one (1) structural engineer, and one (1) architect. The Board shall advise the Commission on problems relating to the safety of fills and of structures on fills."

TITLE 22. Social Security \ Division 4. Environmental Health \ Chapter 17. Surface Water Treatment\ Article 1. General Requirements and Definitions \ §64651.66. Qualified Engineer.

"'Qualified engineer' means a Civil Engineer, registered in the State of California, with 3 years experience in water treatment design, construction, operation, and watershed evaluations."

Appendix D. Examples of Code Sections (continued)

TITLE 22. Social Security \ Division 4.5. Environmental Health Standards for the Management of Hazardous Waste \ Chapter 14. Standards for Owners and Operators of Hazardous Waste Transfer, Treatment, Storage, and Disposal Facilities \ Article 8. Financial Requirements \ §66264.143. Financial Assurance for Closure.

"(1) Within 60 days after receiving certifications from the owner or operator and an independent professional engineer, registered in California, that final closure has been completed in accordance with the approved closure plan, the Department shall notify the owner or operator in writing that they are no longer required by this section to maintain financial assurance for final closure of the facility, unless the Department has reason to believe that final closure has not been in accordance with the approved closure plan. The Department shall provide the owner or operator a detailed written statement of any such reason to believe that closure has not been in accordance with the approved closure plan."

Appendix E. Titles included in the California Code of Regulations

Title 1.	General Provisions
Title 2.	Administration
Title 3.	Food and Agriculture
Title 4.	Business Regulations
Title 5.	Education
Title 6.	Governor [No regulations filed]
Title 7.	Harbors and Navigation
Title 8.	Industrial Relations
Title 9.	Rehabilitative and Developmental Services
Title 10.	Investment
Title 11.	Law
Title 12.	Military and Veterans Affairs
Title 13.	Motor Vehicles
Title 14.	Natural Resources
Title 15.	Crime Prevention and Corrections
Title 16.	Professional and Vocational Regulations
Title 17.	Public Health
Title 18.	Public Revenues
Title 19.	Public Safety
Title 20.	Public Utilities and Energy
Title 21.	Public Works
Title 22.	Social Security
Title 23.	Waters
Title 24.	Building Standards are not published on CCR website
Title 25.	Housing and Community Development
Title 26.	Toxics
Title 27.	Environmental Protection
Title 28.	Managed Health Care

Appendix F: Agency List for California Code of Regulations

ACCOUNTANCY, BOARD OF	LABOR STATISTICS AND RESEARCH, DIVISION OF
ACUPUNCTURE BOARD	LANDS COMMISSION, STATE
ADMINISTRATIVE HEARINGS, OFFICE OF	LANDSCAPE ARCHITECTS TECHNICAL COMMITTEE
ADMINISTRATIVE LAW, OFFICE OF	LIBRARY, CALIFORNIA STATE
AGING, CALIFORNIA DEPARTMENT OF	LOCAL AGENCY DEPOSIT SECURITY, ADMINISTRATION OF
AGRICULTURAL LABOR RELATIONS BOARD	MANAGED HEALTH CARE, DEPARTMENT OF
AIR RESOURCES BOARD	MANDATES, COMMISSION ON STATE
ALCOHOL AND DRUG PROGRAMS, DEPARTMENT OF	MARITIME ACADEMY, CALIFORNIA
ALCOHOLIC BEVERAGE CONTROL APPEALS BOARD	MEDICAL ASSISTANCE COMMISSION, CALIFORNIA
ALCOHOLIC BEVERAGE CONTROL, DEPARTMENT OF	MEDICAL BOARD OF CALIFORNIA
ALLOCATION BOARD, STATE	MEDICAL INSURANCE BOARD, MANAGED RISK
ALTERNATIVE ENERGY AND ADVANCED TRANSPORTATION SOURCE FINANCING AUTHORITY	MENTAL HEALTH, DEPARTMENT OF
APPRENTICESHIP STANDARDS, DIVISION OF	MINING AND GEOLOGY BOARD, STATE
ARBITRATION CERTIFICATION PROGRAM	MOTOR VEHICLES, DEPARTMENT OF
ARCHITECT, DIVISION OF THE STATE	NARCOTIC ADDICT EVALUATION AUTHORITY
ARCHITECTS BOARD, CALIFORNIA	NEW MOTOR VEHICLE BOARD
ARTS COUNCIL, CALIFORNIA	NURSING, BOARD OF REGISTERED
ATHLETIC COMMISSION	NURSING HOME ADMINISTRATOR PROGRAM
AUCTIONEER COMMISSION	OCCUPATIONAL SAFETY AND HEALTH (CAL/OSHA), DIVISION OF
AUTOMOTIVE REPAIR, BUREAU OF	OCCUPATIONAL SAFETY AND HEALTH APPEALS BOARD
BANKING DEPARTMENT, STATE	OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD
BARBERING AND COSMETOLOGY, BUREAU OF	OCCUPATIONAL THERAPY, BOARD OF
BEHAVIORAL SCIENCES, BOARD OF	OPTICIAN PROGRAM, REGISTERED DISPENSING
BOATING AND WATERWAYS, DEPARTMENT OF	OPTOMETRY, STATE BOARD OF
BUSINESS, TRANSPORTATION AND HOUSING AGENCY	OSTEOPATHIC MEDICAL BOARD OF CALIFORNIA
CALIFORNIA SCIENCE CENTER	PARKS AND RECREATION, DEPARTMENT OF
CEMETERY AND FUNERAL BUREAU	PEACE OFFICER STANDARDS AND TRAINING, COMMISSION ON
CHILD SUPPORT SERVICES, DEPARTMENT OF	PERSONNEL ADMINISTRATION, DEPARTMENT OF
CHIROPRACTIC EXAMINERS, BOARD OF	PERSONNEL BOARD, STATE
COASTAL COMMISSION, CALIFORNIA	PEST CONTROL BOARD, STRUCTURAL
COASTAL CONSERVANCY, STATE	PESTICIDE REGULATION, DEPARTMENT OF
COLLECTION AND INVESTIGATIVE SERVICES, BUREAU OF	PHARMACY, CALIFORNIA STATE BOARD OF
COLORADO RIVER BOARD OF CALIFORNIA	PHYSICAL THERAPY BOARD OF CALIFORNIA
COMMUNITY COLLEGES, CALIFORNIA	PHYSICIAN ASSISTANT COMMITTEE
COMMUNITY SERVICES AND DEVELOPMENT, DEPARTMENT OF	PILOT COMMISSIONERS, BOARD OF
CONSERVATION, DEPARTMENT OF	PLANNING AND RESEARCH, OFFICE OF
CONSUMER AFFAIRS, DEPARTMENT OF	PODIATRIC MEDICINE, BOARD OF
CONTRACTORS' STATE LICENSE BOARD	POLLUTION CONTROL FINANCING AUTHORITY, CALIFORNIA
CONTROLLER, STATE	PRISON TERMS, BOARD OF
CORPORATIONS, DEPARTMENT OF	PRIVATE POSTSECONDARY AND VOCATIONAL EDUCATION, BUREAU FOR
CORRECTIONS, BOARD OF	PROCUREMENT, OFFICE OF
CORRECTIONS, CALIFORNIA DEPARTMENT OF	PROFESSIONAL ENGINEERS AND LAND SURVEYORS, BOARD FOR
COSMETOLOGY, BOARD OF	PSYCHOLOGY, BOARD OF
COURT REPORTERS' BOARD OF CALIFORNIA	PUBLIC EMPLOYEES' RETIREMENT SYSTEM
DELTA PROTECTION COMMISSION	PUBLIC EMPLOYMENT RELATIONS BOARD
DENTAL BOARD OF CALIFORNIA	PUBLIC UTILITIES COMMISSION, STATE OF CALIFORNIA
DEVELOPMENTAL SERVICES, DEPARTMENT OF	REAL ESTATE, DEPARTMENT OF
DISPUTE RESOLUTION ADVISORY COUNCIL	REAL ESTATE APPRAISERS, OFFICE OF
ECONOMIC OPPORTUNITY, DEPARTMENT OF	RECLAMATION BOARD
EDUCATION, CALIFORNIA DEPARTMENT OF	REHABILITATION, DEPARTMENT OF
EDUCATIONAL FACILITIES AUTHORITY	RESOURCES AGENCY
ELECTRONIC AND APPLIANCE REPAIR, BUREAU OF	RESPIRATORY CARE BOARD
EMERGENCY MEDICAL SERVICES AUTHORITY	SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
EMERGENCY SERVICES, OFFICE OF	SAN GABRIEL AND LOWER LOS ANGELES RIVERS AND MOUNTAINS CONSERVANCY
EMPLOYMENT DEVELOPMENT DEPARTMENT	SAN JOAQUIN RIVER CONSERVANCY
ENERGY COMMISSION, CALIFORNIA	SANTA MONICA MOUNTAINS CONSERVANCY
ENVIRONMENTAL AFFAIRS AGENCY	SAVINGS AND LOAN, DEPARTMENT OF
ENVIRONMENTAL HEALTH HAZARD ASSESSMENT, OFFICE OF	SCHOLARSHARE INVESTMENT BOARD
ENVIRONMENTAL PROTECTION AGENCY (Cal-EPA), CALIFORNIA	SECRETARY OF STATE
EQUALIZATION, STATE BOARD OF	SECURITY AND INVESTIGATIVE SERVICES, BUREAU OF
EXPOSITION AND STATE FAIR, CALIFORNIA	SEISMIC SAFETY COMMISSION, CALIFORNIA
FAIR EMPLOYMENT AND HOUSING, DEPARTMENT OF	SHORTHAND REPORTERS, BOARD OF CERTIFIED
FAIR EMPLOYMENT AND HOUSING COMMISSION	SMALL AND MINORITY BUSINESS, OFFICE OF
FAIR POLITICAL PRACTICES COMMISSION	SMALL BUSINESS, CALIFORNIA OFFICE OF
FINANCIAL INSTITUTIONS, DEPARTMENT OF	SMALL BUSINESS CERTIFICATION AND RESOURCES, OFFICE OF
FIRE MARSHAL, OFFICE OF THE STATE	SOCIAL SERVICES, DEPARTMENT OF
FISH AND GAME, DEPARTMENT OF	SPEECH-LANGUAGE PATHOLOGY AND AUDIOLOGY BOARD
FISH AND GAME COMMISSION	SPILL PREVENTION AND RESPONSE, OFFICE OF
FOOD AND AGRICULTURE, DEPARTMENT OF	STRUCTURAL PEST CONTROL BOARD
FORESTRY AND FIRE PROTECTION	STUDENT AID COMMISSION, CALIFORNIA
FORESTRY AND FIRE PROTECTION, CALIFORNIA DEPARTMENT OF	TAHOE CONSERVANCY, CALIFORNIA
FRANCHISE TAX BOARD	TAX CREDIT ALLOCATION COMMITTEE, CALIFORNIA
FUNERAL DIRECTORS AND EMBALMERS, BOARD OF	TAX EDUCATION COUNCIL, CALIFORNIA
GAMBLING CONTROL, DIVISION OF	TEACHER CREDENTIALING, COMMISSION ON
GAMBLING CONTROL COMMISSION, CALIFORNIA	TEACHERS' RETIREMENT SYSTEM, STATE
GENERAL SERVICES, DEPARTMENT OF	TECHNOLOGY, TRADE AND COMMERCE AGENCY, CALIFORNIA
GEOLOGISTS AND GEOPHYSICISTS, BOARD FOR	TOXIC SUBSTANCES CONTROL, DEPARTMENT OF
GUIDE DOGS FOR THE BLIND, STATE BOARD OF	TRANSPORTATION, DEPARTMENT OF
HEALTH FACILITIES FINANCING AUTHORITY, CALIFORNIA	TRANSPORTATION COMMISSION, CALIFORNIA
HEALTH AND HUMAN SERVICES AGENCY, CALIFORNIA	TREASURER, STATE
HEALTH PLANNING AND DEVELOPMENT, OFFICE OF STATEWIDE	UNEMPLOYMENT INSURANCE APPEALS BOARD, CALIFORNIA
HEALTH SERVICES, DEPARTMENT OF	UNIVERSITY, BOARD OF TRUSTEES OF THE CALIFORNIA STATE
HEARING AID DISPENSERS BUREAU	VETERANS AFFAIRS, DEPARTMENT OF
HIGHWAY PATROL, DEPARTMENT OF CALIFORNIA	VETERINARY MEDICAL BOARD
HOME FURNISHINGS AND THERMAL INSULATION, BUREAU OF	VICTIM'S COMPENSATION AND GOVERNMENT CLAIMS BOARD
HORSE RACING BOARD, CALIFORNIA	VOCATIONAL NURSE AND PSYCHIATRIC TECHNICIANS, BOARD OF
HOUSING AND COMMUNITY DEVELOPMENT, DEPARTMENT OF	WASTE MANAGEMENT BOARD, CALIFORNIA INTEGRATED
HOUSING FINANCE AGENCY, CALIFORNIA	WATER RESOURCES, DEPARTMENT OF
INDUSTRIAL DEVELOPMENT FINANCING ADVISORY COMMISSION, CALIFORNIA	WATER RESOURCES CONTROL BOARD, STATE
INDUSTRIAL MEDICAL COUNCIL	WORKERS' COMPENSATION, DIVISION OF
INDUSTRIAL RELATIONS, DEPARTMENT OF	WORKERS' COMPENSATION APPEALS BOARD
INDUSTRIAL WELFARE COMMISSION	YOUTH AND ADULT CORRECTIONAL AGENCY
INSURANCE, DEPARTMENT OF	YOUTH AUTHORITY, DEPARTMENT OF THE
JUSTICE, DEPARTMENT OF	YOUTHFUL OFFENDER PAROLE BOARD
LABOR STANDARDS ENFORCEMENT, DIVISION OF	

Appendix G. California Universities Graduate Engineering Programs

Cal Poly Pomona

- Available majors information from Cal Poly Pomona Catalog 1999-2001, pages 492-493.
- Graduate Majors (M.S.):
 - Engineering
 - Minimum 45 quarter units required.
 - Emphasis areas available:
 - Aerospace Engineering
 - Chemical Engineering
 - Civil Engineering
 - Electrical Engineering
 - Engineering Management
 - Environmental Engineering
 - Industrial Engineering
 - Manufacturing Engineering
 - Materials Engineering
 - Mechanical Engineering
 - Structural Engineering
 - Electrical Engineering
 - Minimum 46 quarter units required.
 - Options available:
 - Communication and Microwave Engineering
 - Computer Systems Engineering
 - Control Systems and Robotics Engineering

Cal Poly San Luis Obispo

- Available majors information from 2001-2003 Cal Poly Catalog, pages 190, 197, 202, 210, 214, and 230.
- Minimum 45 quarter units required for each major.
- Graduate Majors (M.S.):
 - Engineering
 - Specializations available:
 - Biochemical Engineering
 - Bioengineering
 - Industrial Engineering
 - Integrated Technology Management
 - Materials Engineering
 - Water Engineering
 - Aerospace Engineering
 - Civil and Environmental Engineering
 - Computer Science
 - Electrical Engineering
 - Mechanical Engineering
- Joint Programs:
 - Engineering Management Specialization, MBA/M.S. Engineering
 - Transportation Planning Specialization, MCRP/M.S. Engineering

San Jose State

- Available majors information from 2000-2001 SJSU Online Catalog.
 - <http://info.sjsu.edu/home/catalog.html>
- Information also drawn from College of Engineering website.
 - <http://www.engr.sjsu.edu/>
- 30 semester units required for each major.
- Graduate Majors (M.S.):
 - Aerospace Engineering
 - Chemical Engineering
 - Areas of Specialization:

Appendix G. California Universities Graduate Engineering Programs (continued)

- Biotechnology
 - Environmental Engineering
 - Semiconductors and Polymer Processing
- Civil Engineering
 - Areas of Specialization:
 - Construction Management
 - Environmental
 - Geotechnical
 - Structural
 - Transportation
 - Water Resources
- Computer Engineering
 - Areas of Specialization:
 - Computer Design
 - Software Engineering
 - Microcomputers and Embedded Systems
 - Computer Vision and Robotics
 - Computer Networks
 - Computer Applications
- Electrical Engineering
- Engineering (Interdisciplinary Program)
 - Areas of Concentration:
 - Client Server Computing
 - Electronic Materials & Devices
 - Engineering Management
 - Environmental Systems
 - Manufacturing Systems
 - Software Systems
 - Special Concentration
- Industrial and Systems Engineering
- Materials Engineering
 - Areas of Concentration:
 - Electronic Materials and Devices
 - Microelectronic Packaging
- Mechanical Engineering
 - Areas of Specialization:
 - Mechanical Engineering Design
 - Thermal/Fluids Engineering Systems
 - Controls and Manufacturing Systems Engineering
- Quality Assurance (Department of Technology)

Stanford

- Available majors information from Stanford Bulletin 2001-2002, pages 103-106; also from Stanford University School of Engineering website (<http://soe.stanford.edu>).
 - The Master of Science (M.S.) degree requires 45 units of coursework and has no thesis requirement.
 - The Engineer's (Engr.) degree requires 45 units of coursework and research combined, as well as a thesis, requiring three quarters of work beyond the M.S..
 - The Doctor of Philosophy (Ph.D.) requires a minimum of 72 units of coursework and research combined, passage of an oral examination, and submission of a dissertation.
- Graduate Majors (M.S., Engr., Ph.D.):
 - Aeronautics and Astronautics
 - Chemical Engineering
 - Civil and Environmental Engineering
 - M.S. degree offered in special field designations.
 - Construction Engineering and Management

Appendix G. California Universities Graduate Engineering Programs (continued)

- Design/Construction Integration
- Environmental Engineering and Science
- Environmental Fluid Mechanics and Hydrology
- Geomechanics
- Structural Engineering
- Computer Science
- Electrical Engineering
- Engineering
 - M.S. in Engineering offered as a broad interdisciplinary program.
 - M.S. degree offered also in two specialized areas.
 - Biomechanical Engineering
 - Product Design
- Engineering in Biology and Medicine
- Management Science and Engineering
 - M.S. degree offered in two areas.
 - Management Science and Engineering
 - Manufacturing Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering
- Scientific Computing and Computational Mathematics
- Space Science

UC Berkeley

- Available majors information from the *2001-2002 Announcement of the College of Engineering, University of California, Berkeley*
 - <http://www.coe.berkeley.edu/Students/announce/>
- Required units information unavailable.
- Graduate Majors (M.S., M.Eng., Ph.D., D.Eng.):
 - Bioengineering (Ph.D.)
 - Joint degree program with the University of California, San Francisco.
 - Civil and Environmental Engineering (M.S., M.Eng., Ph.D., D.Eng.)
 - Areas of specialization:
 - Construction Engineering and Management
 - Environmental Engineering
 - Geoengineering
 - Structural Engineering, Mechanics, and Materials
 - Transportation Engineering
 - Electrical Engineering and Computer Sciences (M.S., M.Eng., Ph.D., D.Eng.)
 - Electrical Engineering program areas:
 - Computer-Aided Design for VLSI
 - Communications
 - Control, Robotics, and Biosystems
 - Solid-State Devices
 - Integrated Circuits
 - Networks
 - Optoelectronics and Electromagnetics
 - Power and Electronics Systems
 - Signal Processing
 - Computer Science program areas:
 - Artificial Intelligence
 - Database Management Systems
 - Human-Computer Interaction
 - Scientific Computing
 - Graphics
 - Operating Systems

Appendix G. California Universities Graduate Engineering Programs (continued)

- Programming Systems
 - Computer Architecture and Engineering
 - Theory
- Industrial Engineering and Operations Research (M.S., Ph.D.)
- Materials Science and Materials Engineering (M.S., M.Eng., Ph.D., D.Eng.)
 - Areas of emphasis:
 - Materials Science, Ceramics, and Physical Metallurgy
 - Mineral Processing/Process Metallurgy
 - Hydrogeology
- Mechanical Engineering (M.S., Ph.D.)
 - Areas of concentration:
 - Dynamics and Controls
 - Fluid and Solid Mechanics
 - Materials and Design
 - Microelectromechanical Systems (MEMS)
 - Thermosciences
 - Manufacturing Processes
 - Computer Mechanics
 - Bioengineering
 - Environmental Engineering
- Nuclear Engineering (M.S., M.Eng., Ph.D., D.Eng.)
 - Program areas:
 - Applied Nuclear Reactions and Instrumentation
 - Bionuclear and Radiological Physics
 - Chemistry and Materials in Nuclear Technology
 - Energy and the Environment
 - Fission Reactor Analysis
 - Fission Reactor Engineering
 - Fusion Reactor Analysis and Engineering
 - Radioactive Waste and Materials Management
 - Risk Analysis
- Interdisciplinary Programs:
 - Applied Science and Technology (Ph.D.)
 - Areas of emphasis:
 - Applied Physics
 - Engineering Science
 - Mathematical Sciences
 - Biophysics (Ph.D.)
 - Ocean Engineering (M.S., M.Eng., Ph.D., D.Eng.)
 - Areas of emphasis:
 - Naval Architecture
 - Offshore Engineering
 - Ocean Engineering

UCLA

- Available majors information from the UCLA General Catalog 2001-2003, pages 90, 94-95.
 - The M.S. requires a total of nine courses (beyond the B.S.) for completion of the degree.
 - Engr. degree signifies a level equivalent to the completion of preliminaries in the Ph.D. program; it does not require a dissertation. It requires a minimum of 15 courses beyond the bachelor's degree.
 - Graduate Certificate of Specialization available in all areas except for Computer Science; each program consists of five courses.
- Graduate Majors:
 - Aerospace Engineering (M.S., Engr., Ph.D.)
 - Biomedical Engineering (M.S., Ph.D.)

Appendix G. California Universities Graduate Engineering Programs (continued)

- Fields of study:
 - Bioacoustics, Speech, and Hearing
 - Biocybernetics
 - Biomechanics, Biomaterials, and Tissue Engineering
 - Biomedical Instrumentation
 - Biomedical Signal and Image Processing
 - Molecular and Cellular Bioengineering
 - Neuroengineering
- Chemical Engineering (M.S., Engr., Ph.D.)
- Civil Engineering (M.S., Engr., Ph.D.)
 - Fields of study:
 - Environmental Engineering
 - Geotechnical Engineering
 - Structures (Structural Mechanics and Earthquake Engineering)
 - Water Resource Systems Engineering
- Computer Science (M.S., M.S./M.B.A., Engr., Ph.D.)
 - Fields of study:
 - Artificial Intelligence
 - Computer Networks
 - Computer Science Theory
 - Computer System Architecture
 - Scientific Computing (Biomedical Systems, Physical Systems)
 - Software Systems
- Electrical Engineering (M.S., Engr., Ph.D.)
 - Fields of study:
 - Applied Mathematics (established minor field only)
 - Communications and Telecommunications
 - Control Systems
 - Electromagnetics
 - Engineering Optimization/Operations Research
 - Integrated Circuits and Systems
 - Photonics and Optoelectronics
 - Plasma Electronics
 - Signal Processing
 - Solid-State Electronics
- Engineering (M.Engr., Engr.)
- Engineering and Applied Science (Graduate Certificate of Specialization)
- Integrated Manufacturing Engineering (M.Engr.)
- Manufacturing Engineering (M.S.)
- Materials Science and Engineering (M.S., Ph.D.)
 - Fields of study:
 - Ceramics and Ceramic Processing
 - Electronic Materials
 - Structural Materials
- Mechanical Engineering (M.S., Engr., Ph.D.)
 - Fields of study:
 - Applied Mathematics (established minor field only)
 - Applied Plasma Physics and Fusion Engineering (minor field only)
 - Dynamics
 - Fluid Mechanics
 - Heat and Mass Transfer
 - Manufacturing and Design
 - Microelectromechanical Systems (MEMS)
 - Structural and Solid Mechanics
 - Systems and Control

Appendix G. California Universities Graduate Engineering Programs (continued)

USC

- Available majors information from USC Catalog 2001-2002, pages 458-539.
 - The M.S. can be completed either with or without a thesis, and requires a minimum of 27 semester units.
 - The Engr. degree requires a minimum of 30 semester units of graduate coursework beyond the M.S.
 - The Ph.D. requires a minimum of 60 semester units of graduate coursework, passage of qualifying exams, and a doctoral dissertation.
- Graduate Majors:
 - Aerospace Engineering (M.S., Engr., Ph.D.)
 - Aerospace Engineering (Astronautics) (M.S.)
 - Applied Mechanics (M.S.)
 - Biomedical Engineering (M.S., Ph.D.)
 - Biomedical Engineering (Biomedical Imaging and Telemedicine) (M.S.)
 - Chemical Engineering (M.S., Engr., Ph.D.)
 - Civil Engineering (M.S., Engr., Ph.D.)
 - Computer-Aided Engineering (Master of Engineering)
 - Computer Engineering (M.S., Ph.D.)
 - Computer Science (M.S., Ph.D.)
 - M.S. specializations:
 - Software Engineering
 - Computer Networks
 - Multimedia and Creative Technologies
 - Robotics and Automation
 - Computational Linguistics
 - Construction Management (Master of Construction Management)
 - Electrical Engineering (M.S., Engr., Ph.D.)
 - M.S. options:
 - Computer Networks
 - Multimedia and Creative Technologies
 - VLSI Design
 - Engineering Management (M.S.)
 - Environmental Engineering (M.S., Ph.D.)
 - Industrial and Systems Engineering (M.S., M.S./M.B.A., Engr., Ph.D.)
 - Integrated Media Systems (M.S.)
 - Manufacturing Engineering (M.S.)
 - Materials Engineering (M.S.)
 - Materials Science (M.S., Engr., Ph.D.)
 - Mechanical Engineering (M.S., Engr., Ph.D.)
 - M.S. areas of concentration:
 - Combustion and Propulsion
 - Continuum Mechanics
 - Controls and Guidance
 - Design Methodology
 - Dynamics and Vibrations
 - Fluid Dynamics
 - Heat Transfer
 - Intelligent Design Systems
 - Stress Analysis and Materials
 - Operations Research Engineering (M.S.)
 - Petroleum Engineering (M.S., Engr., Ph.D.)
 - Systems Architecture and Engineering (M.S.)

Civil Engineering Exam Topics

			Civil Reference #
1. Environmental	A. Wastewater Treatment	1) Wastewater flow rates	1A1
		2) Primary clarification	1A2
		3) Biological treatment	1A3
		4) Secondary clarification	1A4
		5) Chemical precipitation	1A5
		6) Sludge systems	1A6
		7) Digesters	1A7
		8) Disinfection	1A8
		9) Nitrification/denitrification	1A9
		10) Effluent limits	1A10
		11) Wetlands	1A11
		12) Unit processes	1A12
		13) Operations	1A13
	B. Biology (including micro & aquatic)	1) Toxicity	1B1
		2) Algae	1B2
		3) Food chain	1B3
		4) Stream degradation	1B4
		5) Organic load	1B5
		6) Oxygenation/deoxygenation/oxygen sag curve	1B6
		7) Eutrophication	1B7
		8) Temperature	1B8
		9) Indicator organisms	1B9
		10) Disinfection	1B10
		11) Water taste & odor	1B11
		12) Most probable number (MPN)	1B12
		13) BOD	1B13
		14) Quality control	1B14
	C. Solid/Hazardous Waste	1) Collection	1C1
		2) Storage/transfer	1C2
		3) Treatment	1C3
		4) Disposal	1C4
		5) Quantity estimates	1C5
		6) Site & haul economics	1C6
		7) Energy recovery	1C7
		8) Hazardous waste systems	1C8
		9) Applicable standards	1C9
	D. Ground Water and Well Fields	1) Dewatering	1D1
		2) Well analysis	1D2
		3) Water quality analysis	1D3
		4) Subdrain systems	1D4
		5) Groundwater flow	1D5
		6) Groundwater contamination	1D6
		7) Recharge	1D7
		8) Aquifers (e.g., characterization)	1D8

¹ This appendix includes copies of the material for comparing the NCEES exam outlines for chemical, control systems, electrical & computer, fire protection, industrial, mechanical, manufacturing and nuclear engineering with civil engineering. The format of this same information was modified slightly so that the same procedure could also be followed in comparing electrical & computer engineering and mechanical engineering to the other disciplines.

Appendix H. NCEES Exam Outline Review Material (continued)**Civil Engineering Exam Topics**

			Civil Reference #
2. Geotechnical	A. Subsurface Exploration and Sampling	1) Drilling & sampling procedures.....	2A1
		2) In-situ testing.....	2A2
		3) Soil classification.....	2A3
		4) Boring log interpretation	2A4
		5) Soil profile development.....	2A5
	B. Engineering Properties of Soils	1) Index properties	2B1
		2) Phase relationships.....	2B2
		3) Shear strength properties.....	2B3
		4) Permeability	2B4
	C. Soil Mechanics Analysis	1) Effective & total stresses.....	2C1
		2) Pore pressure	2C2
		3) Pressure distribution	2C3
		4) Lateral earth pressure	2C4
		5) Consolidation	2C5
		6) Compaction.....	2C6
		7) Slope stability.....	2C7
		8) Seepage	2C8
		9) Erosion.....	2C9
	D. Shallow Foundations	1) Bearing capacity	2D1
		2) Settlement.....	2D2
		3) Allowable bearing pressure.....	2D3
		4) Proportioning individual/combined footings	2D4
		5) Mat & raft foundations	2D5
		6) Pavement design	2D6
	E. Deep Foundations	1) Axial capacity (single pile/drilled shaft).....	2E1
		2) Lateral capacity (single pile/drilled shaft).....	2E2
		3) Settlement.....	2E3
		4) Lateral deflection.....	2E4
		5) Behavior of pile/drilled shaft groups	2E5
		6) Pile dynamics.....	2E6
		7) Pile load tests.....	2E7
	F. Earth Retaining Structures	1) Gravity walls.....	2F1
		2) Cantilever walls.....	2F2
		3) Mechanically stabilized earth wall	2F3
		4) Braced & anchored excavations.....	2F4
		5) Earth dams.....	2F5
		6) Earth pressure diagrams.....	2F6
		7) Stability analysis	2F7
		8) Serviceability requirements	2F8
	G. Seismic Engineering	1) Earthquake fundamentals	2G1
		2) Liquefaction potential evaluation	2G2

Appendix H. NCEES Exam Outline Review Material (continued)**Civil Engineering Exam Topics**

			Civil Reference #
3. Structural	A. Loadings	1) Dead & live loads	3A1
		2) Moving loads	3A2
		3) Wind loads	3A3
		4) Earthquake loads	3A4
		5) Repeated loads	3A5
	B. Analysis	1) Determinate	3B1
		2) Indeterminate	3B2
		3) Shear diagrams	3B3
		4) Moment diagrams	3B4
	C. Mechanics of Materials	1) Flexure	3C1
		2) Shear	3C2
		3) Torsion	3C3
		4) Tension & compression	3C4
		5) Combined stresses	3C5
		6) Flexure, shear, tension & compression	3C6
		7) Deflection	3C7
	D. Materials	1) Reinforced concrete	3D1
		2) Pre-stressed concrete	3D2
		3) Structural steel	3D3
		4) Timber	3D4
		5) Concrete mix design	3D5
		6) Masonry	3D6
		7) Composite construction	3D7
	E. Member Design	1) Beams	3E1
		2) Slabs	3E2
		3) Columns	3E3
		4) Reinforced concrete footings	3E4
		5) Pile foundations	3E5
		6) Retaining walls	3E6
		7) Trusses	3E7
		8) Braces & connections	3E8
		9) Shear and bearing walls	3E9
	F. Failure Analysis	1) Buckling	3F1
		2) Fatigue	3F2
		3) Failure modes	3F3
	G. Design Criteria	1) UBC, BOCA, SBC, ACI, PCI, AISC, NDS, AASHTO, ASCE-7	3G1

Appendix H. NCEES Exam Outline Review Material (continued)**Civil Engineering Exam Topics**

			Civil Reference #
4. Transportation	A. Traffic Analysis	1) Traffic signal.....	4A1
		2) Speed studies	4A2
		3) Capacity analysis	4A3
		4) Intersection analysis.....	4A4
		5) Parking operations	4A5
		6) Traffic volume studies	4A6
		7) Mass transit studies	4A7
		8) Sight distance	4A8
		9) Traffic control devices	4A9
		10) Pedestrian facilities	4A10
		11) Bicycle facilities.....	4A11
		12) Driver behavior/performance.....	4A12
	B. Transportation Planning	1) Origin-destination studies.....	4B1
		2) Site impact analysis	4B2
		3) Capacity analysis	4B3
		4) Optimization/cost analysis.....	4B4
		5) Trip generation/distribution/assignment.....	4B5
	C. Construction	1) Excavation/embankment.....	4C1
		2) Material handling.....	4C2
		3) Optimization	4C3
		4) Scheduling	4C4
		5) Mass diagrams.....	4C5
		6) Pavement design	4C6
	D. Geometric Design	1) Horizontal curves	4D1
		2) Vertical curves	4D2
		3) Sight distance	4D3
		4) Superelevation	4D4
		5) Vertical/horizontal clearances	4D5
		6) Acceleration & deceleration.....	4D6
		7) Intersections/interchanges	4D7
	E. Traffic Safety	1) Accident analysis	4E1
		2) Roadside clearance analysis.....	4E2
		3) Counter-measurement development.....	4E3
		4) Economic analysis	4E4
		5) Conflict analysis	4E5

Appendix H. NCEES Exam Outline Review Material (continued)**Civil Engineering Exam Topics**

			Civil Reference #
5. Water Resources	A. Hydraulics	1) Spillway capacity.....	5A1
		2) Energy dissipation.....	5A2
		3) Energy/continuity equation.....	5A3
		4) Pressure conduit.....	5A4
		5) Open channel flow.....	5A5
		6) Detention/retention ponds.....	5A6
		7) Pump application and analysis.....	5A7
		8) Pipe network analysis.....	5A8
		9) Flow rates.....	5A9
		10) Stormwater collection.....	5A10
		11) Flow rates (domestic, irrigation, fire).....	5A11
		12) Surface water profile.....	5A12
		13) Cavitation.....	5A13
		14) Friction/minor losses.....	5A14
		15) Sub- & supercritical flow.....	5A15
		16) Hydraulic jump.....	5A16
		17) Flow measurement devices.....	5A17
		18) Flow equations.....	5A18
		19) Culvert design.....	5A19
		20) Velocity control.....	5A20
	B. Hydrology	1) Storm characterization.....	5B1
		2) Storm frequency.....	5B2
		3) Hydrograph (unit & others).....	5B3
		4) Transpiration.....	5B4
		5) Evaporation.....	5B5
		6) Permeation.....	5B6
		7) Rainfall intensity & duration.....	5B7
		8) Runoff analysis.....	5B8
		9) Gauging stations.....	5B9
		10) Flood plain/floodway.....	5B10
		11) Sedimentation.....	5B11
	C. Water Treatment	1) Demands.....	5C1
		2) Hydraulic loading.....	5C2
		3) Storages (raw & treated water).....	5C3
		4) Rapid mixing.....	5C4
		5) Flocculation.....	5C5
		6) Sedimentation.....	5C6
		7) Filtration.....	5C7
		8) Disinfection.....	5C8
		9) Applicable standards.....	5C9

Appendix H. NCEES Exam Outline Review Material (continued)

Chemical Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

		Chemical Reference #	Equivalent Civil Reference #*
1. Mass and Energy Balances	A. Process stoichiometry and material balances	1A	
	B. Process energy balances	1B	
	C. Conservation laws	1C	
2. Heat Transfer Industrial heat transfer including but not limited to the following:	A. Heat exchanger design and performance	2A	
	B. Energy conservation	2B	
	C. Conduction, especially insulation problems	2C	
	D. Convection	2D	
	E. Radiation, especially furnace design	2E	
	F. Evaporation	2F	
3. Fluids	A. Piping network problems	3A	
	B. Pump sizing or pump performance	3B	
	C. Compressor sizing or compressor performance	3C	
	D. Control valve selection problems	3D	
	E. Fluid flow through beds	3E	
	F. Two-phase flow	3F	
	G. Bernoulli equation applications	3G	
4. Thermodynamics	A. Estimation and correlation of physical properties	4A	
	B. Chemical equilibrium	4B	
	C. Heats of reaction	4C	
	D. Application of first and second laws	4D	
	E. Vapor-liquid equilibrium	4E	
	F. Combustion	4F	
	G. Refrigeration	4G	
5. Mass Transfer Typical applications including but not limited to the following:	A. Gas absorption and stripping	5A	
	B. Distillation	5B	
	C. Liquid-liquid extraction and leaching	5C	
	D. Humidification and dehumidification	5D	
	E. Drying	5E	
6. Kinetics	A. Interpretation of experimental data and reaction rate modeling	6A	
	B. Commercial reactor design from rate model and/or product distribution	6B	
	C. Comparison of reactor types	6C	
	D. Reaction control	6D	
7. Plant Design Process and equipment design including but not limited to the following	A. Optimization of design	7A	
	B. General safety considerations	7B	
	C. Environmental and waste treating	7C	
	D. Solids separation	7D	
	E. Vapor-liquid separations	7E	
	F. Flow sheets	7F	
	G. HAZOP (hazard and operational) analysis	7G	
	H. Fault tree analysis	7H	
	I. Scheduling techniques	7I	
	J. Sizing and fabrication of equipment	7J	
	K. Material selection	7K	
	L. Life cycle cost	7L	
	M. Process control such as sensors, transmitters and controllers, control loops, and simulation	7M	
	N. Material science as concerned with physical and chemical properties of matter, strength of materials, crystallographic structure, phase diagrams, latent heat, PVT data and relationships, and molecular structure	7N	

* Leave blank if no equivalent

Appendix H. NCEES Exam Outline Review Material (continued)

Control Systems Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

		Control Systems Reference #	Equivalent Civil Reference #*
1. Sensors	A. Fundamentals of Measurement	1A	
	B. Sensor Principles	1B	
	C. Selection and Installation Practices	1C	
2. Analog and Digital Data Transmission	A. Conductor Pairs	2A	
	B. Coaxial Cable	2B	
	C. Fiber Optics	2C	
	D. Shielding and Grounding	2D	
	E. Protocols	2E	
3. Valves and Final Elements	A. Fluid Mechanics	3A	
	B. Valve Characteristics	3B	
	C. Selection	3C	
	D. Sizing and Installation Practices	3D	
	E. Relief Valves	3E	
4. Process Dynamics	A. Mass and Energy Balances	4A	
	B. Fluid Flow and Heat Transfer for Typical Processes	4B	
	C. Transfer Functions	4C	
	D. Responses to Standard Inputs	4D	
	E. Process Identification by Plant Tests	4E	
5. Control System Analysis	A. Block Diagrams	5A	
	B. Stability	5B	
	C. Accuracy and Response-Time Considerations	5C	
6. Controllers/ Modes/Tuning	A. Controller and Mode Selection	6A	
	B. Tuning Procedures	6B	
7. Digital Control Systems	A. Hardware And Software Fundamentals	7A	
8. Discrete Logic, Interlocks, Alarms and Sequencing	A. Logic Elements	8A	
	B. Timers/Counters	8B	
	C. Design Tools	8C	
	D. Recommended Practices	8D	
9. Codes and Standards	A. Wiring	9A	
	B. Burner/Boiler/Pressure Vessel Safety	9B	
10. Documentation	A. Standard Symbols for Process And Instrument Drawings ..	10A	
	B. Logic Diagrams	10B	
	C. Displays	10C	
11. Economics of Control	A. Costs	11A	
	B. Benefits	11B	
	C. Payout Criteria	11C	

* Leave blank if no equivalent

Appendix H. NCEES Exam Outline Review Material (continued)

Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Breadth Module	1. Basic Electrical Engineering	A. Professionalism and Engineering Economics	1) Engineering Economics	1A1	_____
			2) Ethics	1A2	_____
			3) Professional Practice	1A3	_____
		B. Safety and Reliability	1) Reliability	1B1	_____
			2) Electric Shock and Burns	1B2	_____
			3) General Public Safety	1B3	_____
		C. Electric Circuits	1) Ohm's Law	1C1	_____
			2) Coulomb's Law	1C2	_____
			3) Faraday's Law	1C3	_____
			4) Kirchhoff's Laws	1C4	_____
			5) Thevenin's Theorem	1C5	_____
			6) Norton's Theorem	1C6	_____
			7) Superposition	1C7	_____
			8) Source Transformation	1C8	_____
			9) Sinusoidal Steady State Analysis	1C9	_____
			10) Power and Energy Calculations	1C10	_____
			11) Transient Analysis	1C11	_____
			12) Fourier Analysis	1C12	_____
	13) Transfer Functions		1C13	_____	
	14) Complex Impedance		1C14	_____	
	15) Laplace Transforms		1C15	_____	
	16) Mutual Inductance	1C16	_____		
	D. Electric and Magnetic Field Theory and Applications	1) Electrostatic Effects	1D1	_____	
		2) Magnetostatic Fields	1D2	_____	
	2. Electronics, Electronic Circuits and Components	A. Components	1) Digital Logic	1E1	_____
1) Solid State Device Characteristics and Ratings ..			2A1	_____	
2) Operational Amplifiers			2A2	_____	
3) Transistors			2A3	_____	
4) Signal Grounding			2A4	_____	
B. Electrical and Electronic Materials		5) Transducers/Sensors	2A5	_____	
		1) Conductivity/Resistivity	2B1	_____	
		2) Thermal Characteristics	2B2	_____	
		3) Semiconductors	2B3	_____	
		3. Controls and Communications Systems	A. Controls and Communications Systems	1) System Stability	3A1
2) Frequency Response	3A2			_____	
3) Analog Modulation	3A3			_____	
4) Frequency Selective Filters	3A4			_____	
4. Power	A. Transmission and Distribution	1) Voltage Regulation	4A1	_____	
		2) Power Factor Correction	4A2	_____	
		3) Grounding	4A3	_____	
	B. Rotating Machines and Electromagnetic Devices	1) AC and DC Machines	4B1	_____	
		2) Transformers	4B2	_____	

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Appendix H. NCEES Exam Outline Review Material (continued)

Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Computers Depth Module	5. General Computer Systems	A. Interpretation of Codes and Standards	1) IEEE Standards	5A1	
			2) ISO Standards	5A2	
		B. Microprocessor Systems	1) Number Systems and Codes	5B1	
			2) Microprocessor Systems		
			a) Components	5B2a	
			b) Control Applications	5B3b	
			c) Math Applications	5B4c	
			d) Programmable Logic Controllers	5B5d	
			e) Real-time Operations	5B6e	
6. Hardware	A. Digital Electronics		1) Memory Devices	6A1	
			2) Medium Scale Integration Devices	6A2	
			3) Programmable Logic Devices and Gate Arrays	6A3	
			4) Tristate Logic	6A4	
			5) Digital Electronic Devices	6A5	
			6) Logic Components		
			a) Properties	6A6a	
			b) Fan-In, Fan-Out	6A6b	
			c) Propagation Delay	6A6c	
			7) Large Scale Integration	6A7	
			8) Analog to Digital and Digital to Analog Conversion	6A8	
	B. Design and Analysis		1) Clock Generation/Distribution	6B1	
			2) Memory Interface	6B2	
			3) Processor Interfacing	6B3	
			4) Asynchronous Communication	6B4	
			5) Metastability	6B5	
			6) Races and Hazards	6B6	
			7) State Transition Tables	6B7	
			8) State Transition Diagrams	6B8	
			9) Algorithmic State Machine Charts	6B9	
			10) Timing Diagrams	6B10	
			11) Synchronous State Machines	6B11	
			12) Asynchronous State Machines	6B12	
			13) Pipelining and Parallel Processing	6B13	
			14) Fault Tolerance	6B14	
			15) Sampling Theory	6B15	
	C. Systems		1) Digital Signal Processor Architecture	6C1	
			2) Design for Testability	6C2	
			3) Computer Architecture	6C3	
			4) Mass Storage Devices	6C4	
			5) Input/Output Devices	6C5	
			6) Central Processing Unit Architecture	6C6	

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Appendix H. NCEES Exam Outline Review Material (continued)

Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Computers Depth Module (Continued)	7. Software	A. System Software	1) Computer Security.....	7A1	
			2) Real-Time Operating Systems.....	7A2	
			3) Error Detection and Control	7A3	
			4) Drivers	7A4	
			5) Time Critical Scheduling	7A5	
	B. Development/ Applications		1) Computer Control and Monitoring.....	7B1	
			2) Software Lifecycle		
			a) Requirements Definition.....	7B2a	
			b) Specification	7B2b	
			c) Design.....	7B2c	
			d) Implementation and Debugging	7B2d	
			e) Testing	7B2e	
			f) Maintenance and Upgrade	7B2f	
			3) Fault Tolerance	7B3	
			4) Modeling and Simulation	7B4	
			5) Software Pipelining.....	7B5	
			6) Human Interface Requirements.....	7B6	
			7) Software Design Methods and Doc- umentation		
			a) Structured Programming	7B7a	
			b) Top Down or Bottom Up Programming ...	7B7b	
			c) Successive Refinement.....	7B7c	
			d) Programming Specifications	7B7d	
			e) Program Testing	7B7e	
			f) Structure Diagrams	7B7f	
			g) Recursion.....	7B7g	
			8) Object Oriented Design	7B8	
			9) Data Structures		
			a) Internal.....	7B9a	
			b) External.....	7B9b	
8. Networks	A. Networks	1) Protocols	a) TCP/IP	8A1a	
			b) Ethernet	8A1b	
		2) Computer Networks	a) OSI Model.....	8A2a	
			b) Network Topology	8A2b	
			c) Network Technology	8A2c	
			d) Network Security.....	8A2d	

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Appendix H. NCEES Exam Outline Review Material (continued)

Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Electronics, Controls, and Communication Depth Module	9. General Electrical Engineering Knowledge	A. Measurement and Instrumentation	1) Transducer Characteristics.....	9A1	
			2) Frequency Response	9A2	
			3) Quantization	9A3	
			4) Data Evaluation	9A4	
			5) Sampling Theory	9A5	
		B. Interpretation of Codes and Standards	1) ANSI Standards.....	9B1	
			2) NEC (code).....	9B2	
			3) IEEE Standards	9B3	
			4) FCC Standards.....	9B4	
			5) EIA Standards	9B5	
			6) ISA Standards	9B6	
			7) ISO Standards	9B7	
		C. Computer Systems	1) Programmable Logic Devices	9C1	
			2) Computer Networks.....	9C2	
			3) Number Systems and Codes	9C3	
			4) Digital Electronic Devices	9C4	
	10. Electronics	A. Electric Circuit Theory	1) Small Signal and Large Signal.....	10A1	
			2) Active Networks and Filters	10A2	
			3) Delay	10A3	
			4) Distributed Parameter Circuits.....	10A4	
			5) Nonlinear Circuits	10A5	
			6) Two Port Theory	10A6	
			7) Phase Delay	10A7	
		B. Electric and Magnetic Field Theory and Applications	1) Microwave Systems.....	10B1	
			2) Transmission Line Models	10B2	
			3) Electromagnetic Fields and Interference	10B3	
			4) Antennas	10B4	
			5) Free Space Propagation.....	10B5	
			6) Guided Wave Propagation.....	10B6	
		C. Electronic Components and Circuits	1) Programmable Logic Devices	10C1	
			2) Programmable Gate Arrays	10C2	
			3) Solid State Power Devices and Applications	10C3	
			4) Battery Characteristics and Ratings.....	10C4	
			5) Power Supplies	10C5	
			6) Phase Locked Loops	10C6	
			7) Oscillators	10C7	
			8) Amplifiers	10C8	
			9) Modulators and Demodulators.....	10C9	
			10) Discrete Components	10C10	
			11) Diodes	10C11	
			12) Circuit Protection	10C12	
			13) Relays and Switches	10C13	
			14) Logic Components a) Properties.....	10C14a	
			b) Fan In, Fan Out	10C14b	
			c) Propagation Delay.....	10C14c	
			15) Transistors and Applications.....	10C15	

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Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Electronics, Controls, and Communications Depth Module (Continued)	11. Controls	A. Control System Fundamentals	1) Difference Equations	11A1	
			2) z – Transform	11A2	
			3) Frequency Response	11A3	
			4) Characteristic Equations.....	11A4	
			5) Block Diagrams	11A5	
			6) State Variable Analysis.....	11A6	
		B. Control System Design/ Implementation	1) Compensators	11B1	
			2) Feed Forward	11B2	
			3) Feedback	11B3	
			4) Optimal Control Systems.....	11B4	
			5) Adaptive Control	11B5	
			6) Computer Control and Monitoring.....	11B6	
			7) Error Actuated Control.....	11B7	
			8) Proportional-Integral-Derivative Control.....	11B8	
		C. Stability	1) Stability Analysis and Design	a) Nyquist Stability	11C1a
				b) Root Locus	11C1b
				c) Bode Diagrams	11C1c
			2) Poles and Zeros	11C2	
			3) Phase and Gain Margin.....	11C3	
			4) Transport Delay.....	11C4	
	12. Commu- nications	A. Communications and Signal Processing	1) Modulation Theory	a) Linear Modulation	12A1a
				b) Angle Modulation	12A1b
				c) Pulse Modulation	12A1c
			2) Correlation and Convolution	12A2	
			3) Fourier Transformers.....	12A3	
			4) Spectral Properties.....	12A4	
			5) Signal Processing.....	12A5	
			6) Digital Transmission	12A6	
			7) Quadrature Amplitude Modulation	12A7	
			8) Personal Communication System.....	12A8	
			9) Spread Spectrum Modulation	12A9	
			10) Adaptive Filtering.....	12A10	
			11) Nyquist Sampling Theorem	12A11	
		B. Noise and Interface	1) Signal to Noise Ratio	12B1	
			2) Quantization Noise	12B2	
			3) Noise Figure and Temperature.....	12B3	
			4) Aliasing.....	12B4	
			5) Random Variables	12B5	
			6) Error Detection and Correction	12B6	
		C. Telecom- munications	1) Wireless Communications	12C1	
			2) Compression	12C2	
			3) Cellular Communications.....	12C3	
			4) Optical Communications.....	12C4	
			5) Circuit and Packet Switching	12C5	
			6) Network Distribution Systems.....	12C6	
			7) Wireline Communications.....	12C7	

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Appendix H. NCEES Exam Outline Review Material (continued)

Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Power Depth Module	13. General Power Engineering	A. Measurement, Instrumentation and Statistics	1) Power Metering.....	13A1	
			2) Instrument Transformers.....	13A2	
			3) Transducers.....	13A3	
			4) Frequency Response of Measurement Devices.....	13A4	
			5) Data Evaluation	13A5	
			6) Reliability	13A6	
		B. Special Applications	1) Illumination Design.....	13B1	
			2) Lightning and Surge Protection.....	13B2	
		C. Codes and Standards	1) ANSI Standards	13C1	
			2) NEC (code).....	13C2	
			3) IEEE Standards	13C3	
			4) NEMA Standards	13C4	
			5) NESC (code).....	13C5	
	14. Circuit Analysis	A. Analysis	1) Short Circuit Analysis.....	14A1	
			2) Wye-Delta Transformation	14A2	
			3) Three-Phase Circuit Analysis.....	14A3	
			4) Symmetrical Components	14A4	
			5) Balanced and Unbalanced Systems	14A5	
			6) Per Unit Analysis	14A6	
		B. Devices and Power Electronic Circuits	1) Solid State Power Device Characteristics and Ratings ..	14B1	
			2) Battery Characteristics and Ratings	14B2	
			3) Power Supplies	14B3	
			4) Relays and Switches.....	14B4	
			5) Power Electronics	14B5	
		C. Electric and Magnetic Fields and Applications	1) Transmission Line Models	14C1	
			2) Mechanical Forces Between Conductors.....	14C2	
			3) Electromagnetic Fields, Coupling, and Interference	14C3	
			4) Electrostatics	14C4	
			5) Ferroresonance	14C5	
	15. Rotating Machines and Electromagnetic Devices	A. Rotating Machines	1) Synchronous Machines.....	15A1	
			2) Induction Machines	15A2	
			3) DC Machines	15A3	
			4) Machine Constants and Nameplate Data.....	15A4	
			5) Equivalent Circuits	15A5	
			6) Response Times.....	15A6	
			7) Speed-Torque Characteristics	15A7	
			8) Speed Control.....	15A8	
			9) Motor Starting	15A9	
			10) Variable Speed Drives	15A10	
			11) Testing.....	15A11	
		B. Electro- magnetic Devices	1) Transformers	15B1	
			2) Reactors	15B2	
			3) Magnetic Circuit Theory	15B3	
			4) Testing.....	15B4	

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Appendix H. NCEES Exam Outline Review Material (continued)

Electrical & Computer Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)

				Electrical & Computer Reference #	Equivalent Civil Reference #*
Power Depth Module (Continued)	16. Transmission and Distribution	A. System Analysis	1) Voltage Drop and Voltage Regulation	16A1	_____
			2) Power Factor Correction	16A2	_____
			3) Parallel Three-Phase Systems.....	16A3	_____
			4) Surge Protection	16A4	_____
			5) Power Quality	16A5	_____
			6) Fault Current Analysis.....	16A6	_____
			7) Grounding.....	16A7	_____
			8) Resistance Grounding	16A8	_____
			9) Transformer Connections	16A9	_____
			10) Models.....	16A10	_____
	B. Power System Performance		1) Load Flow	16B1	_____
			2) Models	16B2	_____
			3) Power System Stability	16B3	_____
			4) Voltage Profile	16B4	_____
			5) Computer Control and Monitoring	16B5	_____
	C. Protection		1) Overcurrent Protection.....	16C1	_____
			2) Protective Relaying	16C2	_____
			3) Protective Devices	16C3	_____
			4) Coordination	16C4	_____

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Appendix H. NCEES Exam Outline Review Material (continued)

Fire Protection Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

		Fire Protection Reference #	Equivalent Civil Reference #*
1. Planning and Design of Water Supplies	A. Water supplies dedicated to fire protection	1A	_____
	B. Public water supplies	1B	_____
2. Planning and Design of Building Systems	A. Structural fire resistance	2A	_____
	B. Fire barriers	2B	_____
	C. Opening protection.....	2C	_____
	D. Means of egress	2D	_____
	E. Construction materials	2E	_____
	F. Smoke management systems	2F	_____
	G. Building use and occupancy	2G	_____
3. Planning and Design of Water-Based Suppression Systems	A. Specifying, evaluating, testing, and maintaining sprinkler and waterspray systems.....	3A	_____
	B. Fire and explosion suppression systems.....	3B	_____
4. Planning and Design of Non Water-Based Suppression Systems	A. Specifying, evaluating, testing, and maintaining CO ₂ , dry chemical, foam, and alternate agent systems.....	4A	_____
	B. Fire and explosion suppression systems.....	4B	_____
5. Planning and Design of Detection and Alarm Systems	A. Specifying, evaluating, testing and maintaining heat, smoke, and flame detectors	5A	_____
	B. Alarm and supervisory systems	5B	_____
6. Planning and Design of Fire Prevention	A. Control of combustible materials, ignition sources, and oxidizing agents.....	6A	_____
7. Implementation and Monitoring of Fire Prevention	A. Inspection, testing and preventive maintenance.....	7A	_____
	B. Process safety	7B	_____
	C. Hazard abatement	7C	_____
8. Research and Development of Hazard and Risk Analysis	A. Quantification of frequency and severity of fire events	8A	_____
	B. Estimation of time available for occupant egress from rooms	8B	_____
	C. Analysis of damage potential to exposed objects from fire or explosion	8C	_____

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Appendix H. NCEES Exam Outline Review Material (continued)

Industrial Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

		Industrial Reference #	Equivalent Civil Reference #*
1. Facilities	A. Site selection.....	1A	_____
	B. Plant layout	1B	_____
	C. Equipment.....	1C	_____
	D. Material handling and waste management systems	1D	_____
	E. Packaging equipment.....	1E	_____
	F. Capacity analysis	1F	_____
	G. Power service and other utility requirements	1G	_____
2. Manufacturing	A. Products.....	2A	_____
	B. Manufacturing processes	2B	_____
	C. Maintenance procedures.....	2C	_____
	D. Operations sequencing	2D	_____
	E. Machine grouping.....	2E	_____
	F. Robotics	2F	_____
	G. Automation.....	2G	_____
	H. Value engineering	2H	_____
3. Production and Inventory Systems	A. Forecasting	3A	_____
	B. Production scheduling.....	3B	_____
	C. Project scheduling	3C	_____
	D. Production control	3D	_____
	E. Resource planning	3E	_____
	F. Logistics	3F	_____
	G. Distribution	3G	_____
4. Work Systems and Ergonomics	A. Measuring work.....	4A	_____
	B. Methods analysis	4B	_____
	C. Incentive and other payment plans.....	4C	_____
	D. Workplace design.....	4D	_____
	E. Human-machine interfacing	4E	_____
	F. Industrial hygiene and safety.....	4F	_____
5. Quality Assurance	A. Quality assurance plans	5A	_____
	B. Reliability analysis.....	5B	_____
	C. Control procedures.....	5C	_____
	D. Capability analysis	5D	_____
	E. Quality aspects of design	5E	_____
6. Management and Computer/ Information Systems	A. Organization design	6A	_____
	B. Staffing plans	6B	_____
	C. Productivity	6C	_____
	D. Human resources.....	6D	_____
	E. Computer systems analysis and design	6E	_____
	F. Specification of computer equipment.....	6F	_____
	G. Computer communication protocols	6G	_____

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Appendix H. NCEES Exam Outline Review Material (continued)

Mechanical Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

		Mechanical Reference #	Equivalent Civil Reference #*
1. General Principles and Practices	A. Relevant Engineering Terminology	1A	_____
	B. Materials Properties	1B	_____
	C. Materials Selection	1C	_____
	D. Control Systems Components	1D	_____
	E. Fluid Mechanics	1E	_____
	F. Heat Transfer	1F	_____
	G. Mass Transfer	1G	_____
	H. Economic Analyses	1H	_____
	I. Project Management	1I	_____
	J. Ethics	1J	_____
	K. Regulations and Laws	1K	_____
	L. Industry and Company Design Standards	1L	_____
	M. Interpretation of Technical Drawings	1M	_____
	N. Electrical Principles	1N	_____
2. Machine Design and Materials	A. Strength of Materials	2A	_____
	B. Fatigue Theory	2B	_____
	C. Vibration Analysis	2C	_____
	D. Statics and Dynamics	2D	_____
	E. Bearings	2E	_____
	F. Gears	2F	_____
	G. Springs	2G	_____
	H. Shafts	2H	_____
	I. Fasteners	2I	_____
	J. Welding	2J	_____
	K. Kinematics	2K	_____
	L. Pressure Vessels	2L	_____
	M. Structural Analysis	2M	_____
	N. Mechanism Analysis	2N	_____
	O. Fits & Tolerances	2O	_____
	P. Manufacturing Processes	2P	_____
	Q. Quality Control	2Q	_____
3. Hydraulics and Fluids	A. Compressor Processes	3A	_____
	B. Compression Processes	3B	_____
	C. Compressible Flow	3C	_____
	D. Incompressible Flow	3D	_____
	E. Stress Analysis	3E	_____
	F. Hydraulic Pumps	3F	_____
	G. Hydraulic and Pneumatic Lines, Fittings, and Control Components ..	3G	_____

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Appendix H. NCEES Exam Outline Review Material (continued)**Mechanical Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)**

		Mechanical Reference #	Equivalent Civil Reference #*
4. Energy Conversion/ Power Systems	A. Combustion Processes.....	4A	_____
	B. Thermodynamic Cycles.....	4B	_____
	C. Thermodynamic Properties	4C	_____
	D. Energy Balances	4D	_____
	E. Heat Exchangers.....	4E	_____
	F. Feedwater Heaters	4F	_____
	G. Cooling Towers	4G	_____
	H. Steam Generators.....	4H	_____
	I. Turbines.....	4I	_____
	J. Condensers.....	4J	_____
	K. Pumps/Compressors/Fans	4K	_____
	L. Power Systems	4L	_____
	M. Steam	4M	_____
	N. Gas	4N	_____
	O. Combined Cycles	4O	_____
	P. Internal Combustion	4P	_____
5. HVAC and Refrigeration	A. Psychrometrics.....	5A	_____
	B. Refrigerants.....	5B	_____
	C. Refrigeration Components.....	5C	_____
	D. Thermodynamics.....	5D	_____
	E. Vibration Control.....	5E	_____
	F. Acoustics	5F	_____
	G. Evaporators/Chillers.....	5G	_____
	H. Condensers.....	5H	_____
	I. Boilers & Furnaces.....	5I	_____
	J. Cooling Towers	5J	_____
	K. Cooling/heating Cycles	5K	_____
	L. Refrigeration Systems.....	5L	_____
	M. Air Quality Requirement.....	5M	_____
	N. Air Distribution Systems	5N	_____
	O. Water Distribution Systems	5O	_____
6. Codes and Standards	P. Energy Recovery.....	5P	_____
	Q. Cooling/Heating Coils.....	5Q	_____
	R. Humidification/Dehumidification	5R	_____
	A. ASTM, ANSI, ASME	6A	_____
	B. FM, NFPA, ASHRAE, BOCA, UBC, SBCC.....	6B	_____

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Appendix H. NCEES Exam Outline Review Material (continued)

Manufacturing Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

			Manu- facturing Reference #	Equivalent Civil Reference #*
1. Product Process Design, Materials Application	A. Materials Engineering & Applications	1) Metals.....	1A1	
		2) Plastics	1A2	
		3) Fluids	1A3	
	B. Product/ Process Design	1) R&D, prototyping, testing	1B1	
		2) Concurrent engineering	1B2	
		3) Design for X		
		a) Manufacturing	1B3a	
		b) Assembly	1B3b	
		c) Maintenance	1B3c	
		d) System constraints	1B3d	
		e) Environment/recycling.....	1B3e	
		4) Engineering graphics/CAD.....	1B4	
		5) Engineering design analysis		
		a) Modeling of products	1B5a	
		b) Simulation of processes.....	1B5b	
		c) Finite element analysis	1B5c	
		d) Risk analysis.....	1B5d	
		e) Probability of success	1B5e	
		f) Independence of requirements	1B5f	
		g) Other aspects of engineering design analysis.....	1B5g	
		6) Cost engineering analysis		
		a) Make vs. buy.....	1B6a	
		b) Variable vs. fixed costs	1B6b	
		c) Capital budgeting/cost justification of production systems or equipment.....	1B6c	
		d) Value engineering	1B6d	
		7) Tolerance analysis/GD&T	1B7	
		8) Process design and development.....	1B8	
2. Manu- facturing Processes	A. Material Removal		2A	
	B. Fabrication, Joining and Assembly	1) Fabrication processes.....	2B1	
		2) Joining and assembly processes	2B2	
	C. Forming	1) Casting and molding processes	2C1	
		2) Hot and cold forming processes	2C2	
		3) Powders processing	2C3	
	D. Finishing	1) Surface modification	2D1	
		2) Coatings	2D2	
		3) Surface performance (e.g., friction, corrosion, etc.)	2D3	

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Appendix H. NCEES Exam Outline Review Material (continued)**Manufacturing Engineering Exam Topics for Comparison with Civil Engineering Exam Topics (Continued)**

			Manu- facturing Reference #	Equivalent Civil Reference #*
3. Pro- duction Systems, Controls & Equipment Design	A. Production Systems & Control	1) Tool and equipment selection	3A1	_____
		2) Production system design.....	3A2	_____
		3) Safety, health and OSHA		_____
		a) Environmental impact	3A3a	_____
		b) Ergonomics.....	3A3b	_____
		4) Facility design/plant layout.....	3A4	_____
		5) Process planning	3A5	_____
		6) Capacity planning	3A6	_____
		7) Cost justification	3A7	_____
		8) CAM/CIM systems	3A8	_____
	B. Equipment Design	1) Machine design.....	3B1	_____
		2) Jig and fixture design.....	3B2	_____
		3) Tool design	3B3	_____
4. Quality		1) Probability and statistics		_____
		a) Frequency analysis	41a	_____
		b) Reliability	41b	_____
		c) Analysis of variance	41c	_____
		2) Statistical control methods (sampling/charting/etc.)	42	_____
		3) Process and equipment capability analysis.....	43	_____
5. Manu- facturing Manage- ment		4) Inspection and testing.....	44	_____
		5) Systems analysis and problem solving	45	_____
		1) Project management.....	51	_____
		2) Business/engineering ethics	52	_____
		3) Production planning and inventory control		_____
		a) Line balancing.....	53a	_____
		b) Quantitative methods	53b	_____
		c) Theory of constraints	53c	_____
		d) Queuing theory	53d	_____
		e) Learning curves	53e	_____

* Leave blank if no equivalent

Appendix H. NCEES Exam Outline Review Material (continued)

Nuclear Engineering Exam Topics for Comparison with Civil Engineering Exam Topics

		Nuclear Reference #	Equivalent Civil Reference #*
1. Nuclear Power Systems	A. NSSS	1A	_____
	B. BOP (e.g. Heat exchangers)	1B	_____
	C. Thermal hydraulics applications	1C	_____
	D. PRA.....	1D	_____
	E. Energy generation	1E	_____
2. Nuclear Fuel and Waste Management	A. Material balance	2A	_____
	B. Fuel composition design.....	2B	_____
	C. Economic analysis.....	2C	_____
	D. Depletion and burn up	2D	_____
	E. Radioactive materials handling.....	2E	_____
	F. Radioactive material storage (including spent fuel)	2F	_____
	G. Radioactive material transportation	2G	_____
	H. High and low level waste disposal	2H	_____
	I. High and low level waste treatment	2I	_____
3. Nuclear Radiation Protection/Radiation Shielding	A. Radioactive material control and monitoring	3A	_____
	B. Dose assessment.....	3B	_____
	C. Environmental surveillance.....	3C	_____
	D. Regulatory compliance	3D	_____
	E. Decontamination	3E	_____
4. Nuclear Criticality/Kinetics/Neutronics	A. Analysis of critical and subcritical systems	4A	_____
	B. Single and multi group calculations	4B	_____
	C. Point kinetics	4C	_____
	D. Bare and reflected systems	4D	_____
	E. Effects of strong absorbers.....	4E	_____
	F. Reactivity calculations	4F	_____
5. Nuclear Measurements and Instruments	A. Radiation detection.....	5A	_____
	B. Sensors	5B	_____
	C. Instrumentation and control	5C	_____
	D. Counting statistics	5D	_____
	E. Electronics of instruments	5E	_____

* Leave blank if no equivalent.

Appendix I: Comments in Response to Forum Questions from a Chemical Engineer Licensed in Three States.

(Name withheld) As background, I have been a registered professional chemical engineer in California since 1980. I now live and primarily practice engineering in Arizona, where I have been registered since 1991, and have operated a small consulting firm since 1995. I also have been registered to practice in New Mexico since 2001. The Arizona and New Mexico registrations were obtained through reciprocity/comity based on the California registration. I earned my BS degree (1973) in chemical engineering from the University of California at Davis, and my MS degree (1975) in chemical engineering from U. C. Berkeley.

I have recently experienced a direct loss in consulting engineering income as a result of California's Title Act. I am a team member of a design group working on a new science building for a San Jose area high school. The specific design area I was contracted to perform was for potable water distribution and wastewater drains from new science labs, and piping of low pressure natural gas to lab stations. These systems were designed per applicable Code requirements. I contacted the California Board for Professional Engineers and Land Surveyors after reviewing their web site for specific requirements for use of engineering seals in California. I was told that the City reviewers would reject plans submitted sealed by a chemical engineer, but the seal of a mechanical engineer would be needed....

Arizona also registers engineers by discipline (branch), but broadly defines the typical work performed by different disciplines. The standard applied is as a professional, one is expected to operate within their area of competence. For example, a civil engineer specializing in bridges may want to get help before working on wastewater treatment facilities. Arizona recognizes a number of engineering branches, including agricultural, chemical, civil, control systems, electrical, environmental, fire protection, geological, industrial, mechanical, metallurgical, mining, nuclear, petroleum, sanitary, and structural. The definitions (as provided in Arizona Administrative Code Title 4, Chapter 30, Rules of the Arizona State Board of Technical Registration, R4-30-221. Engineering Branches Recognized) are broad in nature, with considerable overlap potential between branches. The regulations also explicitly state "the branches do not limit the areas of a registrants practice of engineering". There are a number of specific instances cited in Arizona to protect the public such as requiring that a licensed electrical engineer seal drawings and specifications where voltage or amperage limits exceed specified values (R4-30-302). Public safety is protected by these specific exclusions.

As a registered chemical engineer in Arizona I have designed and sealed plans for industrial ventilation from microelectronics facilities (Motorola, Intel); managed design and installation of: chemical fume scrubbers (Chem Research Co); particulate scrubbers (TRW); hot (1200F) compressed air (300 psig) distribution systems (Honeywell); industrial wastewater treatment from metal finishing operations (CRC); wastewater effluent from semiconductor processing facilities (Motorola, ATMI, Intel). I have also sealed drawings for potable water distribution in commercial buildings (retail and restaurants), and natural gas supply lines in a restaurant. My qualifications and competency to successfully and safely perform these services has never been questioned; all projects have been successfully completed....

I carry errors and omissions (E&O) insurance for my engineering practice. It is not priced based on state of registration, or even where the majority of the work is performed. If the insurers do not feel it necessary to charge different premiums for coverage in different geographic locations (as is the case for automobile insurance), it seems very reasonable to conclude the public is protected at comparable loss rates in all US jurisdictions. The part that seems very unreasonable to me is the arbitrary narrow discipline definitions in California's current laws unnecessarily restrict my ability to provide competent services there. The only rationale for continuing the current rules is to cater to the special interests of the three practice act disciplines. This does not promote public safety, and quite likely leads to higher consumer prices because it restricts reasonable competition.